

Predicting Elbow River flood flow rates and recurrence intervals (1870's-present).

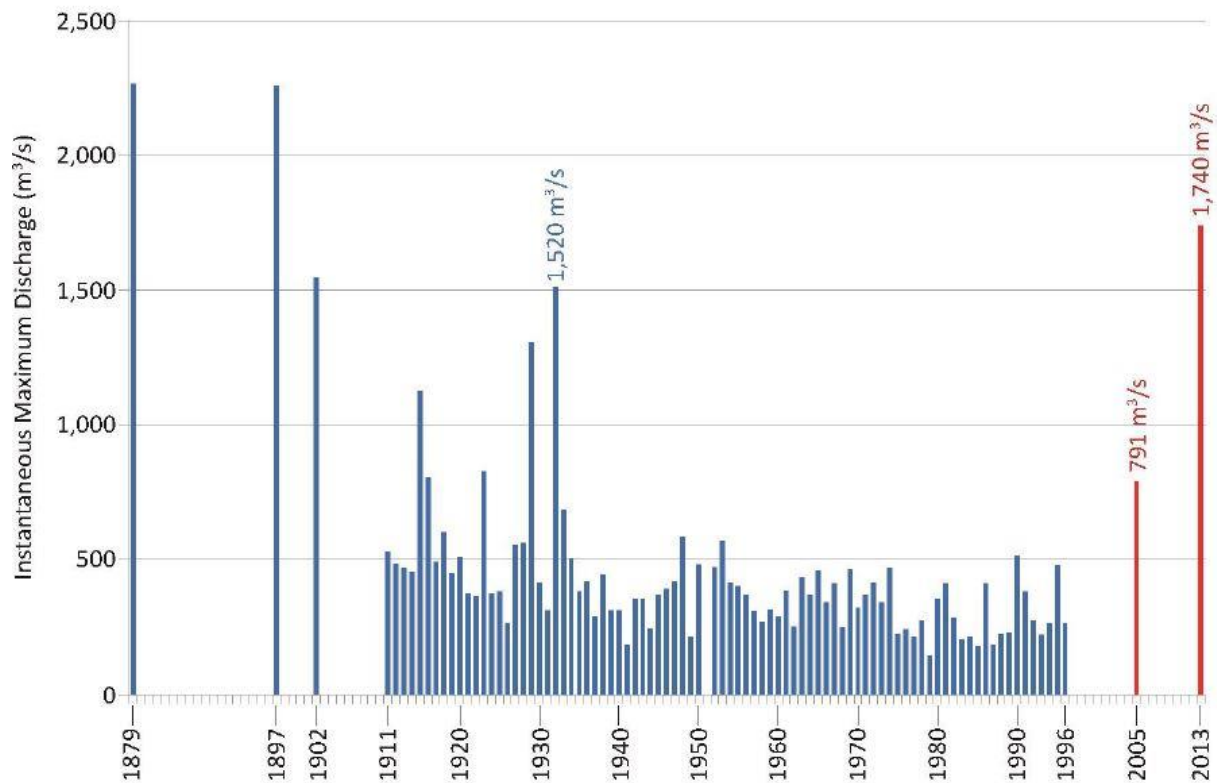
Dave Klepacki, SR1 Concerned Landowners Group, February 2021.

“This year's flooding isn't the worst that Calgary has seen, says historian Harry Sanders. He lists, in order, the three worst floods to hit the city occurred in 1879, 1897 and 1902. (Jonathan Hayward/Canadian Press July 29, 2013)”



The Calgary historian Harry Sanders lists 1897 as the second worst flood in Calgary's history (1879 being the worst). This photo of the 1897 event was taken looking west from a point on the south bank of the Bow River near Langevin Bridge, which connects Bridgeland to the southeast side of what is now downtown. (Glenbow Museum).

Figure 2: Maximum Water Discharge in the Bow River at Calgary between 1879 – 2013



Flood events in the Bow River at Calgary in historical time from WaterSmart, 2013.

The Importance of Sample Size for Predicting Flood Frequency

Predictive analytics uses mathematical models to identify future outcomes based on historical data. Many studies show the critical importance of data quality on decision quality (Ghaemaghahi and Calic, 2019). In natural systems, extreme events “live” in the tails of the distribution and it is very important to obtain as large a distribution as reasonable accuracy allows in predicting future events (Mohamed and Sapsis 2018).

The data Stantec used in estimating flood flows along the Elbow River ranged from 1908-2012 (Table 5 and pp 22-23 Springbank Off-Stream Reservoir Project Hydrology Flood Frequency Analysis, Stantec Consulting Ltd 2015; and Appendix B.2 Springbank Off-Stream Project Hydrology Flood Frequency Analysis, March 31, 2017, Section 2.1). The data Golder Engineering used in its analysis of flood frequency was 1911-2015 for the Bow River and 1908-2015 for the Elbow River

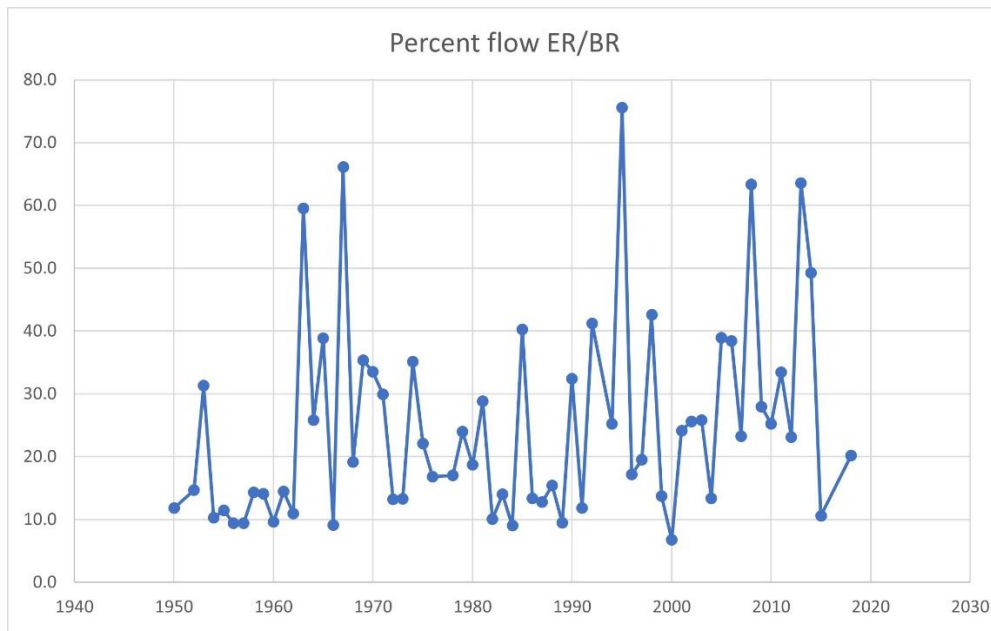
Each of these analyses does not capture 3 other significant flood events comparable to 2013, including the largest historical observed flood in Calgary in 1879. There were three floods of similar or larger magnitude to the 2013 event: 1879, 1897, 1902. These four floods occurred over

a 134 year period suggesting a recurrence interval much less than the 1:200 year Stantec assigns to the 2013 event.

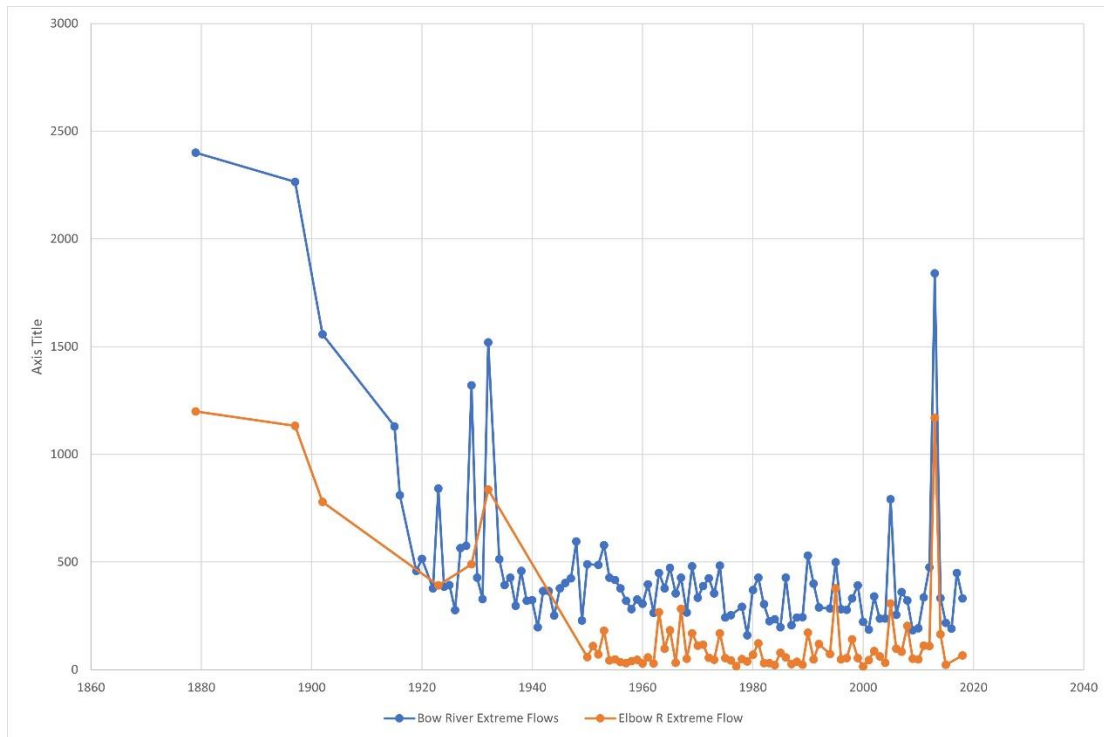
There are no measurements for the flow rate of the 1879, 1897 and 1902 events for the Elbow River. The flow estimates for 1897 and 1902 were calculated from high water marks on a CP Rail bridge over the Bow River. The 2013 flood flow destroyed gauges along the river so flow rates were calculated by high water elevation at Glenmore Reservoir and high water elevation at Bragg Creek. Wagner-Watchel calculated flows of 1096m³/s to 1215m³/s using channel surveys, highwater marks and Slope-Area method with Ven Te Chow's Iteration.

Golder Associate's December 2020 report (pp 43-44) uses a log Pearson Type III statistical calculation as described in USGS Bulletin 17C, as a method for calculating an adjustment ratio for the Elbow River relative to the Bow River. The adjustment ratio for the Elbow is to increase the flow rate calculated from the 1908-2015 series by 1.25 for a 1/100 yr flood and 1.30 for a 1/200 yr flood. Using this method within 95% certainty yields calculated flow rates for the Elbow River (below Glenmore dam) of 310-821m³/s for a 1/100 yr flood and 397-1130 for a 1/200 yr flood. The difficulty with this method is that the Bow River's flood flow upstream from Calgary became altered by dams constructed from 1910 to 1963, with the construction of the Ghost Dam in 1929 especially significant on flow rates.

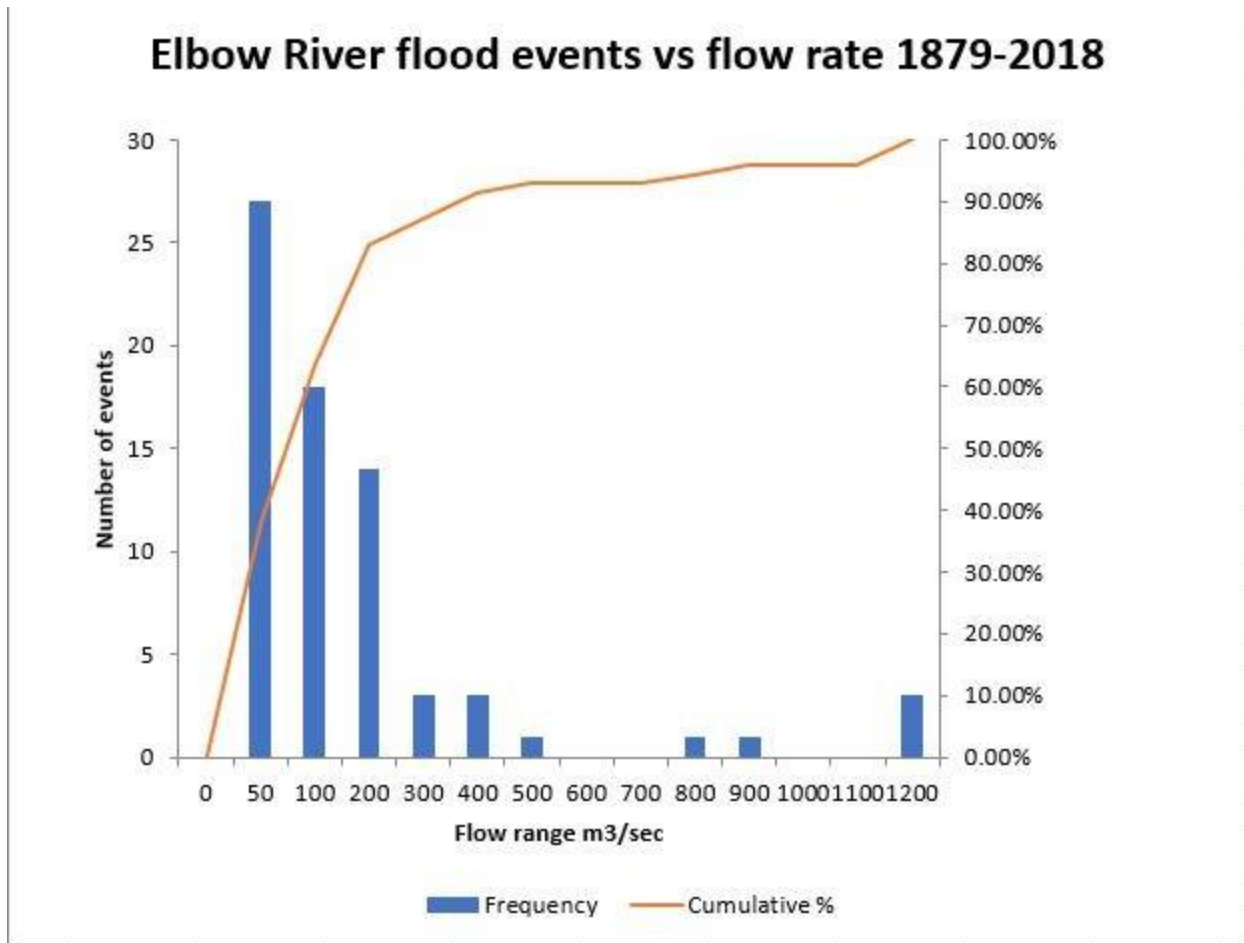
Given the range of uncertainty in quantifying flood flows for the Elbow River, I use a simple method of assigning an adjustment ratio between the Bow and Elbow river using peak flow data for flood years and calculating Elbow River flood volumes for 1879, 1897, and 1908. The following graph illustrates this ratio.



If one uses a conservative value of 0.50 for the ER/BR ratio (recognizing the controlled flow for the Bow River in this interval) and applies that value to the 1879, 1897 and 1902 floods the flow rates have the following values:

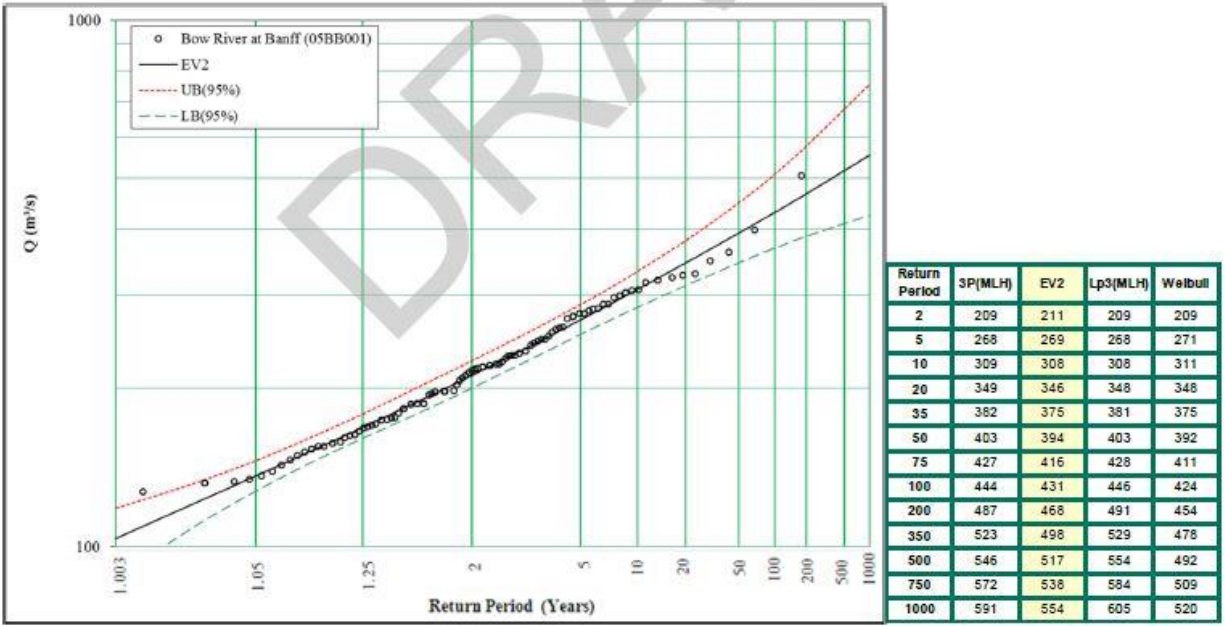


The peak flow values for the interval 1879-2015 can then be plotted on a cumulative frequency (ogive) plot.



Both graphs show the 1879 and 1897 events are in the same frequency bin (1101-1200m³/s) as the 2013 event. This indicates these 3 events, with flows at Bragg Creek larger than 1100m/s constitute 4% of the population and fall into a 1/25 category, and significantly more common than 1/200 assigned by Stantec and Golder using the 1908-2015 dataset with only 1 event was in that category.

To further illustrate the dependence of predictive analytics on data quality and sample size, I compare Golder's (2020) frequency calculation of the 2013 event for the Bow River at Banff to Pomeroy, Stewart and Whitfield's (2015) calculation. Dr John Pomeroy is a world-renowned hydrologist at the University of Saskatchewan and Director of the Global Water Futures Programme who has been working the Marmot Creek Research Station in Kananaskis for decades.



Golder 2020 Log Pearson III flood frequency of the 2013 event for Bow River, Banff using the 1911-2015 dataset. Note the 2013 event lies close to 1:200 event axis.

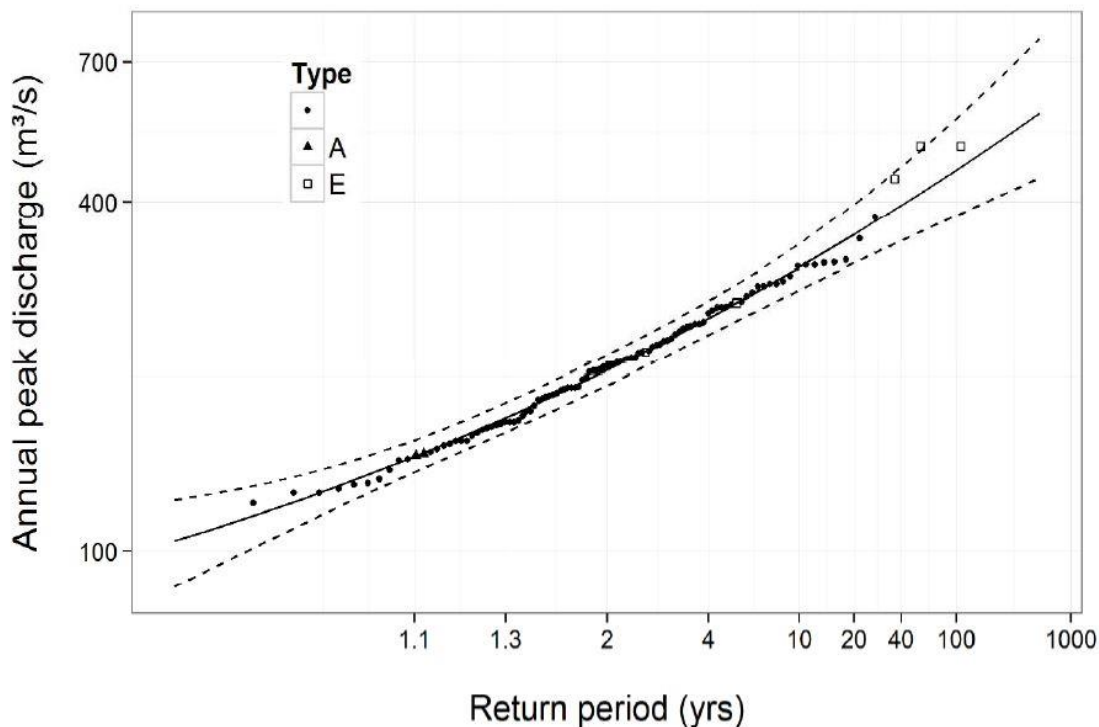


Figure 8. Estimated return periods for the Bow River at Banff from 1884 to 2013 by rank and fitted using the log Pearson type III distribution (solid line) with 95% confidence intervals plotted as dashed lines. Circle is measured peak flow, triangle (A) is annual maximum of a partial year, hollow square (E) is estimated as noted by the Water Survey of Canada. The 2013 event is third from the right ($439 \text{ m}^3/\text{s}$).

Pomeroy, Stewart and Whitfield Log Pearson III plot of the 2013 event for the Bow River at Banff using an 1884-2013 dataset. Note the 2013 event is a 1:40 event with this expanded dataset versus a 1:200 event in the limited Golder 2020 dataset.

The discrepancy in the calculated return period of the 2013 event between the Golder 2020 analysis and the Pomeroy, Stewart and Whitfield 2015 analysis is the larger sample size of the later dataset which includes the 1897 and 1902 events. A larger sample size allows a more accurate analysis.

The importance of including these historic data is to ensure a sample range long enough to capture climatic wet years in determining return periods. The figure below is from Razavi et al. 2016 and shows modelled changes in river flows from regional climatic variations determined from tree-ring reconstructions. Note the wet period evident in the late 1800's and early 1900's. This period corresponds to the historic flood events of 1879, 1897 and 1902. Neglecting to

account for these climate-induced flood events likely leads to significant operational risk for the Springbank Off Stream Reservoir Project and residents in the Elbow River flood plain.

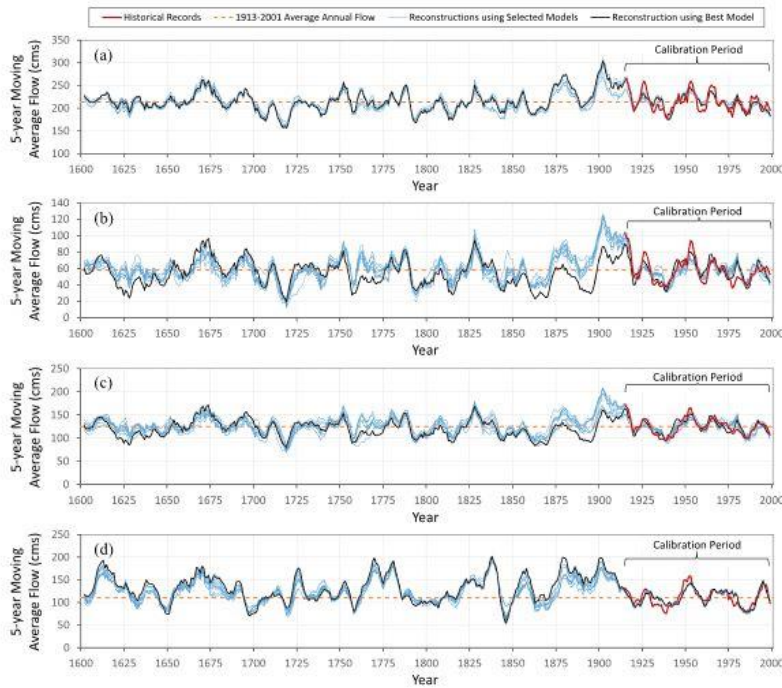


Figure 8. Time series of reconstructed 5-year moving average flows in (a) North Saskatchewan, (b) Red Deer, (c) Bow, and (d) Oldman Rivers. The best model is the model with minimum Akaike information criterion. The shown reconstructed flows for the calibration period are the results of cross-validation

Conclusions:

Stantec and Golder Associates analyses of the flood frequency (return periods) of 2013-like events in the Elbow River watershed are flawed because their input data did not adequately include historic large floods of 1879, 1897, and 1902. Flood events comparable to 2013 are more likely at 1:30-1:50 recurrence intervals as indicated by calculations with appropriate assumptions that include these historic events. There is a significant risk the Springbank Off Stream Reservoir is under-designed for the large flood events in the future. The Changing Cold Regions Network and Global Water Futures predict precipitation and drought extremes will increase in magnitude with our warming climate, generating large floods with more frequent intervals, as well as years of intense drought. The Springbank Off Stream Reservoir project should be abandoned and taxpayer monies reallocated for a project mediating both flood and drought events in the future.

Bow, Elbow, Highwood, and Sheep River Hydrology Assessment, Golder Associates submitted to Alberta and Environment and Parks, September 2020, 318p

Springbank Off-Stream Storage Project Preliminary Design Report, Appendix B.4-1 PMF (Probable Maximum Flood) Analysis Report. Stantec Consulting March 31, 2017,

Ghaemaghaei, M and G. Calic, 2019, Can big data improve firm decision quality? The role of data quality and data diagnosticity. Decision Support Systems. V120, May 2019 pp 38-49

Mohamad M.A, and T. P. Sapsis, 2018 Sequential sampling strategy for extreme event statistics in nonlinear dynamical systems. PNAS, October 30, 2018.

<https://doi.org/10.1073/pnas.1813263115>

Pomeroy, J. W., Stewart, R. E., and Whitfield, P. H.: The 2013 flood event in the South Saskatchewan and Elk River basins: Causes, assessment and damages, Canadian Water Resources Journal, 41, 105–117, 2015.

<http://www.tandfonline.com/doi/abs/10.1080/07011784.2015.1089190>

Razavi, S, A. Elshorbagy, H. Wheater, and D. Sauchyn, 2016, Time Scale effect and uncertainty in reconstruction of paleohydrology. Hydrological Processes. Wiley Online Library. DOI: 10.1002/hyp.10754

Wagner-Watchel, J. 2016, Indirect Methods for Peak Flow Estimation, Southern Alberta Flood, June 2013. Environment Canada Lethbridge Water Monitoring Workshop September 2016.

WaterSMART Solutions Ltd, August 2013. The 2013 Great Alberta Flood: Actions to Mitigate, Manage and Control Future Floods. 27p.



Populations and threats to large wildlife within the Springbank Offstream Reservoir Project Area

Dave Klepacki

SR1 Concerned Landowners Group ("SCLG")

February 2021

In this report I note the substantial difference between between wildlife observations from the Stantec field observations and those reported by west Springbank area residents. Stantec had few observations of elk and threatened grizzly bears in the project areas whereas west Springbank residents reported and photographed many elk, grizzlies and cougars within the project area.



Elk in the reservoir footprint NW/25-24-4W5 August 2016.



Elk in the reservoir footprint along Upper Springbank road, NW/24-24-4W5 February 2021



04-08-2019 02:17:54

Cougar along northeast margin of reservoir SE/25-24-4W5 August 2019



Gizzley Sow and cubs feeding on elk kill on edge of reservoir footprint NW/26-24-4W5 June 2015.

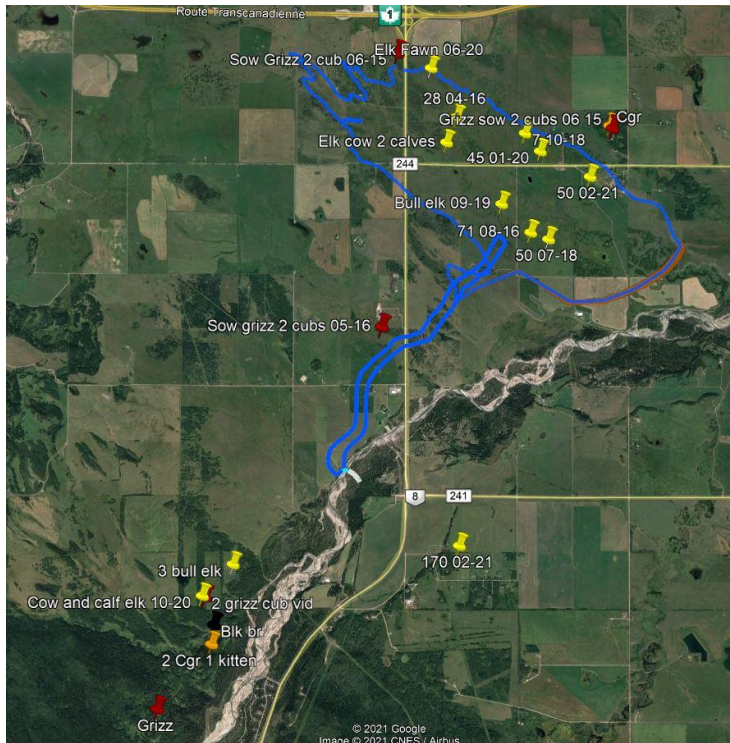


Newborn elk calf along northern boundary of reservoir NW/26-24-4W5 June 2020

Residents of west Springbank, some of whom are descended from settlers, feel the SR1 project will severely disrupt and potentially exterminate the Jumping Pound herd (Jorgenson and Jokinen, 2008), and the carnivores that follow and predate upon this herd. SR1 will irreparably alter the ecosystem and migration corridor between the Elbow and Bow rivers. Construction of the Springbank Offstream Reservoir will remove valuable habitat for winter foraging and spring calving for the Jumping Pound Elk herd.



Sow Grizzly and cubs immediately north of proposed diversion channel, SE/15-24-4W5. June 2016.



Elk, grizzly bear, black bear, and cougar sightings by residents in the Springbank area. The Maximum flood outline of the reservoir area is in blue. Yellow pins are Elk sights and include number and date (when residents had that information), red pins are grizzly bear sightings, black pins are black bear sightings and orange pins are cougar sightings

The SR1 Concerned Landowners Group asserts Stantec inadequately assessed the impact of the SR1 project on wildlife within and adjacent to the project area. We maintain the project will destroy critical boundary habitat of the Foothills Montane and Foothills Parkland ecozones. The project will disrupt movement of the Jumping Pound elk herd and the carnivores that rely upon this herd. We are particularly concerned the Diversion Channel will obstruct northwest to southeast migration movements and that the reservoir will remove critical winter forage and spring calving grounds for this herd. Elk herds along the Foothills are under increasing pressure and in many areas, population declines (Jorgenson and Jokinen, 2008). The SR1 project will jeopardize the survival of the Jumping Pound elk herd with this critical habitat loss.

We also believe the SR1 project will severely disrupt the grizzly bear population in the area. Grizzlies are classified as a Threatened species in Alberta and the limited sightings reported by Stantec failed to recognize the population and the projects threat to this population.

Should the SR1 project be approved, significant additions need to be included by the proponent. These would include migration bridges over the Diversion Structure, grassland, forbs, and shrub growth in the footprint following flooding to permit suitable calving habitat for the elk, and limited traffic of any kind during calving and winter forage times for the herd.

References:

Jorgenson, J.T. and M. Jokinen, 2008, Calgary and Canmore Areas Winter Elk Survey 2008. Alberta Sustainable Resource Development, Fish and Wildlife Division, Canmore

Stantec Springbank Off-Stream Reservoir Project Environmental Impact Assessment volume 3A: Effects Assessment (Construction and Dry Operations). Assessment on Potential Effects on Wildlife and Biodiversity, March 2018

Stantec Springbank Off-Stream Reservoir Project Environmental Impact Assessment Volume 4: Appendices Appendix H: Wildlife and Biodiversity, Attachment 11A Habitat Suitability Models, March 2018



DAVE KLEPACKI, PhD

Bragg Creek, Alberta | 1-403-512-4447 |
Dklepacki@essentialearthmentoring.ca
www.essentialearthmentoring.ca

A credible voice for conservation and environmental organizations built upon a lifelong passion for natural history and connecting others to the landscapes that sustain us. With 33 years in industry (oil & gas) technical and executive positions I am experienced with land use competition and the need to sustain our planetary life support systems. I am currently involved in conservation work in conjunction with Elbow River Watershed Partnership, the Springbank Action Coalition, and Canadian Parks and Wilderness Society.

SKILLS & ABILITIES

- Public Speaking.
- Technical analysis.
- Financing, budgeting and regulatory reporting
- Certified Hiking Guide

EXPERIENCE

- **Environmental work:** Stand for the Upper Elbow. Elbow River Watershed Partnership. Springbank Action Coalition.
- **Oil and gas industry:** Vice President, Wilcox Energy, Norwood Resources, Black Island Resources. Senior Geophysicist Eurogas Corp, Great Plains Exploration, Purcell Energy, PanCanadian Petroleum, Exxon Production Research.
- **Outdoor Leadership:** Outdoor Council of Canada Hiking Guide, Interpretative Guides Association, Wilderness First Aid (40 hr). Led many hikes, canoe, and camp trips for youth groups, Junior Forest Wardens, and professional groups.

EDUCATION

- PhD, Geological Sciences, Massachusetts Institute of Technology, 1978.
- Masters Program University of British Columbia 1978-81,

- BSc Hons (Cum Laude), Geology University of Massachusetts, 1978.

COMMUNICATION

- Mountainview Gazette Op-Ed <https://www.mountainviewgazette.ca/article/bighorn-country-an-opportunity-20181211>
- CBC TV interview <https://www.cbc.ca/news/canada/calgary/alberta-clear-cut-logging-kananaskis-country-opposition-1.4845066>
- CTV interview <https://calgary.ctvnews.ca/environmentalists-concerned-about-fragile-fish-habitat-in-creek-west-of-calgary-1.3925457>
- Calgary Herald Op-Ed <https://calgaryherald.com/opinion/columnists/klepacki-kenney-doesnt-get-to-label-me-a-special-interest>
- 17 peer-reviewed earth science papers in professional journals.
- 26 professional talks
- Spoken as executive at over 25 Annual General Meetings.

LEADERSHIP

- Director Elbow River Watershed Partnership
- Bragg Creek Chamber of Commerce

Curriculum Vitae

Experience

June 2017-Present

Calgary, AB

Founder, Essential Earth Mentoring LP. <https://essentialearthmentoring.ca/>
Experience Journeys Ltd <https://www.experiencejourneys.ca/>

- Essential Earth Mentoring provides planning and executing research projects dealing with resource and environmental issues. .
- Together with Marina Amarin Dawn, Experience Journeys Ltd provides transformational outings that reconnect ourselves with nature. These include Nature Therapy, natural history outings, seminars, and citizen science projects.

April 2010-Present 2017

Calgary, AB

Vice President and director, Wilcox Energy Corp.

- Responsible for geological and geophysical diligence for well locations, technical management and government reporting for Canadian domestic oil and gas production.
- Together with Leo Schnitzler, president, and Rob Solinger, CFO, we have grown Wilcox to 200boepd using horizontal drilling and LPG and slickwater hydrofrack technologies using 3 successful financings.

June 2008-April 2010

Calgary, AB and Vancouver, BC

Vice President, Exploration, Norwood Resources Ltd.

- First discovery and extraction of oil in Central America outside of the Mexican hydrocarbon system. Seismic and geological interpretation and mapping, corporate data organization, and government reporting.
- Technical presentations for and soliciting of 2009 \$5MM corporate financing.
- Well site management with drilling engineers in '08-'09 operations.
- Expert witness in 2009 litigation with service provider.

April 1998-December 2014

Calgary, AB

President, Takowkid Resources Ltd.

- Geophysical and geological consulting including seismic interpretation, processing and acquisition. Special expertise in faulted and folded strata.
- Clients include: Great Plains Exploration, Eurogas Corp (Chief Geophysicist 12 yrs with projects in Tunisia and Spain), Purcell Energy Ltd. Predator Resources, Bolt Energy, Oiltec Resources, Hornet Energy, Tasman Energy, Pinon Oil & Gas, Wascana Energy and Helmsman Res.
- Involved in the discoveries of the Liard Gas Field, Tatagua field, Wauchope field, Baguel field (Tunisia), and many 1-2 well fields in Alberta and Saskatchewan.

June 2003-June 2011

Calgary, AB

Vice President, Black Island Resources Inc.

- Founding partner in private corporation that raised \$3.7MM to drill 3100m Dakota sand producer in Powder River Basin, Wyoming.
- Sold well and land assets (1000 acres) to Sampson Resources for \$2.1MM after 7 years of production.

1992-1998

PanCanadian Petroleum

Calgary, AB

Drumheller Management Team, Staff Geophysicist, Senior Explorationist

- 20 well domestic program in '97, 2 NFW, 2NPW, 2 Suspended. Familiar with Crossfield, Chestermere, Herronton, Homeglen-Westertose areas.

- Coordinator for venture evaluations in South America, Egypt, Holland, and Italy. Involved in North Sea, Kazakhstan, Guatemala and Tunisia efforts.
- Drilled successful Q/13-8 well proving up 15mmbo rcvrble.
- Recommended successful Marathon farm-in and 17mmbo Eocene Tay sand discovery in 22/22b

1996-1997 Rossmin Exploration Calgary AB

Director

- Small gold exploration venture with properties in SE BC. Company sold to Bluebird Resources in Aug. 1997.

1990-1992 Esso Resources Canada Calgary, AB

Senior Explorationist

- Development of North Waterton, Quirk Creek gas pools. Delineation of Murray River gas pool.
- Generated 4 gas prospects, 2 proved up in later drilling.
- Coordinator of foothills structural interpretation group.

1985-1989 Exxon Production Research Co. Houston, TX

Explorationist

- Structural interpretation expert, involved in projects in New Guinea, Statfjord, Gulf of Suez, Columbia, China Sea, Montana, Oklahoma, Wyoming, California resulting in 9 wells: 3 new field discoveries, 3 development wells.
- Developed and/or taught Structural Geology and Seismic Interpretation Schools for Exxon and Esso worldwide.

1982-1984(summers) Geological Survey of Canada Vancouver, BC

Field Party Chief

- Detailed bedrock mapping of 256km² near Kaslo/New Denver mining district Southeastern BC.

1980-1981 Geotex Consultants Vancouver, BC

Consulting Structural Geologist

- First employee for president, Peter Read; together we brought Geotex to 3 full-time, 4 part-time employees in 2 years.

1979 Chevron Minerals Denver, CO

Field Geologist

- Uranium and gold mineral exploration as part of a 4 person crew in the Blue Ridge Mountains near Boone, North Carolina. Diamond drilling with a Winky BQ rig, field geology and stream sediment sampling. Discovered noncommercial uraninite pegmatite.

1978 United States Geological Survey Amherst, MA

Field Geologist

- Assistant to Drs Peter B Read and E-an Zen in geological mapping of central Massachusetts to revise the State Geological Map of Massachusetts.

Summer 1977 University of Massachusetts Amherst, MA

Field Assistant

- Assistant to Robert D. Tucker in geological mapping of the Barre area, central Massachusetts

Summer 1976 University of Massachusetts Amherst, MA

Field Assistant

- Assistant to Richard A Jackson in geological mapping of the Kent Quadrangle, western Connecticut.

Industry Training

- Tau-P Processing of Seismic Data, Dr. Robert Tatum, Calgary AB, Apl. 16, 1997
- 2D & 3D Spatial Sampling in Acquisition and its Impact/Interaction with Processing, PanCanadian Petroleum, Calgary AB, June 9-11, 1997.
- Landmark Advanced Seisworks 3D, Calgary AB, Sept 8-13, 1996.
- International Petroleum Law, Rocky Mountain Mineral Law Assoc., Denver CO, Feb. 12-15, 1995.
- **Financial Planning and Control Seminar for Oil and Gas Company Executives**, Southern Methodist Univ., Dallas TX, March 12-18, 1994.
- Seismic Data Processing (2), Exxon Production Research Co., Houston TX, June 26-30, 1989.
- Seismic Data Processing, Exxon Production Research Co., Houston TX, April 24-28, 1989.
- Seismic Data Gathering, GeoTran Inc., Houston TX, June 19-23, 1989.
- Dipmeter Interpretation Workshop, Exxon Production Research Co., Houston TX, Feb. 2-4, 1987.
- Applied Seismic Interpretation, Exxon Production Research, Houston TX, Nov. 3-21, 1986.
- Velocity and Modeling Interpretation, Exxon Production Research Co., Houston TX, Apl 28-May 9, 1986.

Education

1981–1985 Massachusetts Institute of Technology Cambridge, MA

- Ph.D. in Geology, “Stratigraphy and Structural Geology of the Goat Range area, SE BC.”
- Funded by Schlumberger Chair and Geological Survey of Canada

1978–1980 University of British Columbia Vancouver, BC

- MSC program in Geology, “Structural Geology of the Maeford Lake area, Cariboo Mountains, British Columbia.”

1973–1978 University of Massachusetts Amherst, MA

- B.Sc. Geology, Cum. Laude
- L.R. Wilson Award for excellence in Earth Science.

Volunteer Activities

Stand for the Upper Elbow, 2018-2017 Conservation group organized to better utilize land use along the Elbow River within public lands in the Kananaskis Provincial Park.

Bragg Creek Chamber of Commerce, 2018-2016 representing The Heart of Bragg Creek Cafe and Yoga Studio.

Beakerhead Foundation volunteer, 2013- 2016 Art and Science collaborative

Yoga within the Heart of Bragg Creek, volunteer staff 2010-2016. Various community fund raising and improvement projects.

Assistant Coach, Calgary Wildcat youth football teams. 2006,2004,2003

Assistant Coach, Canucks Stuff Midget Volleyball Team Grande Prairie Tournament. April 2002

Springbank United Church Youth Group Leader, 1992-1999.

Junior Forest Wardens, Bragg Creek Bald Eagles, Assistant Leader, 1994-1998.

Ducks Unlimited Bragg Creek Chapter, Executive Committee. 1995, 1996

American Association of Petroleum Geologists, Associate Editor, 1993-1995.

Bragg Creek Community Church Youth Group Leader, 1990-1992.

Chairman, Board of directors, Bragg Creek Community Church, 1992.

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Murphy, D.C., van der Heyden, P., Parrish, R.R., Klepacki, D.W., McMillan, W., Struik, L.C., and Gabite, J.1995, New geochronological constraints on Jurassic deformation of the western edge of North America, southeastern Canadian Cordillera. in Jurassic magmatism and tectonics of the North American cordillera, D.M. Miller and C. Busby eds., Geological Society of America special paper 299, pp. 159-172l.

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Klepacki, D.W., 1989, Structural hydrocarbon trap styles and their distribution *and* Structural development of the Western United States *in* Western Integrated Exploration Study final report. Exxon Production Research proprietary publication EPR.124ES.89,10p. 36 plates.

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- Klepacki, D. W., 1986, Geology of the Goat Range, Lardeau (82K) and Nelson (82F) Map areas, Southeastern British Columbia, Geological Survey of Canada Open File Map 1148.
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DAVE KLEPACKI, PhD

Bragg Creek, Alberta | 1-403-512-4447 |
Dklepacki@essentialearthmentoring.ca
www.essentialearthmentoring.ca

A credible voice for conservation and environmental organizations built upon a lifelong passion for natural history and connecting others to the landscapes that sustain us. With 33 years in industry (oil & gas) technical and executive positions I am experienced with land use competition and the need to sustain our planetary life support systems. I am currently involved in conservation work in conjunction with Elbow River Watershed Partnership, the Springbank Action Coalition, and Canadian Parks and Wilderness Society.

SKILLS & ABILITIES

- Public Speaking.
- Technical analysis.
- Financing, budgeting and regulatory reporting
- Certified Hiking Guide

EXPERIENCE

- **Environmental work:** Stand for the Upper Elbow. Elbow River Watershed Partnership. Springbank Action Coalition.
- **Oil and gas industry:** Vice President, Wilcox Energy, Norwood Resources, Black Island Resources. Senior Geophysicist Eurogas Corp, Great Plains Exploration, Purcell Energy, PanCanadian Petroleum, Exxon Production Research.
- **Outdoor Leadership:** Outdoor Council of Canada Hiking Guide, Interpretative Guides Association, Wilderness First Aid (40 hr). Led many hikes, canoe, and camp trips for youth groups, Junior Forest Wardens, and professional groups.

EDUCATION

- PhD, Geological Sciences, Massachusetts Institute of Technology, 1978.
- Masters Program University of British Columbia 1978-81,

- BSc Hons (Cum Laude), Geology University of Massachusetts, 1978.

COMMUNICATION

- Mountainview Gazette Op-Ed <https://www.mountainviewgazette.ca/article/bighorn-country-an-opportunity-20181211>
- CBC TV interview <https://www.cbc.ca/news/canada/calgary/alberta-clear-cut-logging-kananaskis-country-opposition-1.4845066>
- CTV interview <https://calgary.ctvnews.ca/environmentalists-concerned-about-fragile-fish-habitat-in-creek-west-of-calgary-1.3925457>
- Calgary Herald Op-Ed <https://calgaryherald.com/opinion/columnists/klepacki-kenney-doesnt-get-to-label-me-a-special-interest>
- 17 peer-reviewed earth science papers in professional journals.
- 26 professional talks
- Spoken as executive at over 25 Annual General Meetings.

LEADERSHIP

- Director Elbow River Watershed Partnership
- Bragg Creek Chamber of Commerce

Curriculum Vitae

Experience

June 2017-Present

Calgary, AB

Founder, Essential Earth Mentoring LP. <https://essentialearthmentoring.ca/>
Experience Journeys Ltd <https://www.experiencejourneys.ca/>

- Essential Earth Mentoring provides planning and executing research projects dealing with resource and environmental issues. .
- Together with Marina Amarin Dawn, Experience Journeys Ltd provides transformational outings that reconnect ourselves with nature. These include Nature Therapy, natural history outings, seminars, and citizen science projects.

April 2010-Present 2017

Calgary, AB

Vice President and director, Wilcox Energy Corp.

- Responsible for geological and geophysical diligence for well locations, technical management and government reporting for Canadian domestic oil and gas production.
- Together with Leo Schnitzler, president, and Rob Solinger, CFO, we have grown Wilcox to 200boepd using horizontal drilling and LPG and slickwater hydrofrack technologies using 3 successful financings.

June 2008-April 2010

Calgary, AB and Vancouver, BC

Vice President, Exploration, Norwood Resources Ltd.

- First discovery and extraction of oil in Central America outside of the Mexican hydrocarbon system. Seismic and geological interpretation and mapping, corporate data organization, and government reporting.
- Technical presentations for and soliciting of 2009 \$5MM corporate financing.
- Well site management with drilling engineers in '08-'09 operations.
- Expert witness in 2009 litigation with service provider.

April 1998-December 2014

Calgary, AB

President, Takowkid Resources Ltd.

- Geophysical and geological consulting including seismic interpretation, processing and acquisition. Special expertise in faulted and folded strata.
- Clients include: Great Plains Exploration, Eurogas Corp (Chief Geophysicist 12 yrs with projects in Tunisia and Spain), Purcell Energy Ltd. Predator Resources, Bolt Energy, Oiltec Resources, Hornet Energy, Tasman Energy, Pinon Oil & Gas, Wascana Energy and Helmsman Res.
- Involved in the discoveries of the Liard Gas Field, Tatagua field, Wauchope field, Baguel field (Tunisia), and many 1-2 well fields in Alberta and Saskatchewan.

June 2003-June 2011

Calgary, AB

Vice President, Black Island Resources Inc.

- Founding partner in private corporation that raised \$3.7MM to drill 3100m Dakota sand producer in Powder River Basin, Wyoming.
- Sold well and land assets (1000 acres) to Sampson Resources for \$2.1MM after 7 years of production.

1992-1998

PanCanadian Petroleum

Calgary, AB

Drumheller Management Team, Staff Geophysicist, Senior Explorationist

- 20 well domestic program in '97, 2 NFW, 2NPW, 2 Suspended. Familiar with Crossfield, Chestermere, Herronton, Homeglen-Westertose areas.

- Coordinator for venture evaluations in South America, Egypt, Holland, and Italy. Involved in North Sea, Kazakhstan, Guatemala and Tunisia efforts.
- Drilled successful Q/13-8 well proving up 15mmbo rcvrble.
- Recommended successful Marathon farm-in and 17mmbo Eocene Tay sand discovery in 22/22b

1996-1997 Rossmin Exploration Calgary AB

Director

- Small gold exploration venture with properties in SE BC. Company sold to Bluebird Resources in Aug. 1997.

1990-1992 Esso Resources Canada Calgary, AB

Senior Explorationist

- Development of North Waterton, Quirk Creek gas pools. Delineation of Murray River gas pool.
- Generated 4 gas prospects, 2 proved up in later drilling.
- Coordinator of foothills structural interpretation group.

1985-1989 Exxon Production Research Co. Houston, TX

Explorationist

- Structural interpretation expert, involved in projects in New Guinea, Statfjord, Gulf of Suez, Columbia, China Sea, Montana, Oklahoma, Wyoming, California resulting in 9 wells: 3 new field discoveries, 3 development wells.
- Developed and/or taught Structural Geology and Seismic Interpretation Schools for Exxon and Esso worldwide.

1982-1984(summers) Geological Survey of Canada Vancouver, BC

Field Party Chief

- Detailed bedrock mapping of 256km² near Kaslo/New Denver mining district Southeastern BC.

1980-1981 Geotex Consultants Vancouver, BC

Consulting Structural Geologist

- First employee for president, Peter Read; together we brought Geotex to 3 full-time, 4 part-time employees in 2 years.

1979 Chevron Minerals Denver, CO

Field Geologist

- Uranium and gold mineral exploration as part of a 4 person crew in the Blue Ridge Mountains near Boone, North Carolina. Diamond drilling with a Winky BQ rig, field geology and stream sediment sampling. Discovered noncommercial uraninite pegmatite.

1978 United States Geological Survey Amherst, MA

Field Geologist

- Assistant to Drs Peter B Read and E-an Zen in geological mapping of central Massachusetts to revise the State Geological Map of Massachusetts.

Summer 1977 University of Massachusetts Amherst, MA

Field Assistant

- Assistant to Robert D. Tucker in geological mapping of the Barre area, central Massachusetts

Summer 1976 University of Massachusetts Amherst, MA

Field Assistant

- Assistant to Richard A Jackson in geological mapping of the Kent Quadrangle, western Connecticut.

Industry Training

- Tau-P Processing of Seismic Data, Dr. Robert Tatum, Calgary AB, Apl. 16, 1997
- 2D & 3D Spatial Sampling in Acquisition and its Impact/Interaction with Processing, PanCanadian Petroleum, Calgary AB, June 9-11, 1997.
- Landmark Advanced Seisworks 3D, Calgary AB, Sept 8-13, 1996.
- International Petroleum Law, Rocky Mountain Mineral Law Assoc., Denver CO, Feb. 12-15, 1995.
- **Financial Planning and Control Seminar for Oil and Gas Company Executives**, Southern Methodist Univ., Dallas TX, March 12-18, 1994.
- Seismic Data Processing (2), Exxon Production Research Co., Houston TX, June 26-30, 1989.
- Seismic Data Processing, Exxon Production Research Co., Houston TX, April 24-28, 1989.
- Seismic Data Gathering, GeoTran Inc., Houston TX, June 19-23, 1989.
- Dipmeter Interpretation Workshop, Exxon Production Research Co., Houston TX, Feb. 2-4, 1987.
- Applied Seismic Interpretation, Exxon Production Research, Houston TX, Nov. 3-21, 1986.
- Velocity and Modeling Interpretation, Exxon Production Research Co., Houston TX, Apl 28-May 9, 1986.

Education

1981–1985 Massachusetts Institute of Technology Cambridge, MA

- Ph.D. in Geology, “Stratigraphy and Structural Geology of the Goat Range area, SE BC.”
- Funded by Schlumberger Chair and Geological Survey of Canada

1978–1980 University of British Columbia Vancouver, BC

- MSC program in Geology, “Structural Geology of the Maeford Lake area, Cariboo Mountains, British Columbia.”

1973–1978 University of Massachusetts Amherst, MA

- B.Sc. Geology, Cum. Laude
- L.R. Wilson Award for excellence in Earth Science.

Volunteer Activities

Stand for the Upper Elbow, 2018-2017 Conservation group organized to better utilize land use along the Elbow River within public lands in the Kananaskis Provincial Park.

Bragg Creek Chamber of Commerce, 2018-2016 representing The Heart of Bragg Creek Caf  and Yoga Studio.

Beakerhead Foundation volunteer, 2013- 2016 Art and Science collaborative

Yoga within the Heart of Bragg Creek, volunteer staff 2010-2016. Various community fund raising and improvement projects.

Assistant Coach, Calgary Wildcat youth football teams. 2006,2004,2003

Assistant Coach, Canucks Stuff Midget Volleyball Team Grande Prairie Tournament. April 2002

Springbank United Church Youth Group Leader, 1992-1999.

Junior Forest Wardens, Bragg Creek Bald Eagles, Assistant Leader, 1994-1998.

Ducks Unlimited Bragg Creek Chapter, Executive Committee. 1995, 1996

American Association of Petroleum Geologists, Associate Editor, 1993-1995.

Bragg Creek Community Church Youth Group Leader, 1990-1992.

Chairman, Board of directors, Bragg Creek Community Church, 1992.

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Klepacki, D.W., Lewis, Richard E., Batchelor, James A., Jensen, Robert E., 2006, Application of Advanced Technology in Validating the Integrity of the Amposta Structure for Gas Storage Offshore Spain. SPE, Prague. And American Association of Petroleum Geologists, European special session, Mallorca, Spain.

Klepacki, D.W., and Batchelor, J.B., 2003, An Active Overthrust Belt and Associated Foredeep in the Chott Region of Central Tunisia – Some Implications for Hydrocarbon Exploration. *In* European Association of Geoscientists and Engineers 1st North African/Mediterranean Petroleum and Geosciences Conference and Exhibition. Tunis 2003.

Newson, A, Klepacki, D., and Cooper, M, 1997: Soft fault linkage in thrust belts, Canadian Society of Petroleum Geologist Annual Meeting.

Klepacki, D. and Umbach, K., 1996, Complex velocity fields and depth conversion in the southern North Sea. Canadian Society of Petroleum Geologists, International Division talk

Murphy, D.C., van der Heyden, P., Parrish, R.R., Klepacki, D.W., McMillan, W., Struik, L.C., and Gabite, J.1995, New geochronological constraints on Jurassic deformation of the western edge of North America, southeastern Canadian Cordillera. in Jurassic magmatism and tectonics of the North American cordillera, D.M. Miller and C. Busby eds., Geological Society of America special paper 299, pp. 159-172l.

Klepacki, D. and Umbach, K.E., 1994, An Alberta-Style Triangle Zone Along the Active Thrust Front in Southern Irian Jaya, Indonesia. Canadian Society of Petroleum Geologists/Canadian Society of Exploration Geophysicists Annual Meeting, May 9-12, 1994, Calgary, Alberta.

Klepacki, Dave, 1994, Thrust Fault Linkage and Considerations for Trap Integrity. Canadian Geological Survey of Canada McConnell Talks on Structural Geology, March, 1994.

Smith, M.T., Gehrels, G.E., and Klepacki, D.W., 1994 , Research Note: 173 Ma U-Pb age of felsite sills (Kaslo River Intrusives) west of Kootenay Lake, southeastern British Columbia, Canadian Journal of Earth Sciences

Klepacki, D, Porter-Chaudry, J., and Keith, C., 1992, Improved interpretation from seismic images using prestack time migration: examples from South Alberta. Canadian Society of Exploration Geophysicists Recorder v18, n.4, p7-8. April, 1993.

Cole, K., Covey, M., DeGraff, J., Klepacki, D., Laubitz, P., and Wong, P., 1991, Relative timing of play elements in the foothills of the Canadian Rocky Mountains, 4p., 39 fig., Exxon Exploration Symposium, Houston, TX, October 1991.

Covey, M.C., Schmidtke, E.A., Klepacki, D.W., and May, S.R., 1991, Phanerozoic tectonic reconstructions of the Northern Cordillera, Evans and Southerland plate tectonic modeling package. Presented at the 1991 Geological Association of Canada Cordilleran Tectonics Workshop, Feb. 22-24, University of Calgary, Calgary, Alberta

Klepacki, D.W., editor, 1990, Hydrocarbon exploration in fold and thrust belts, Exxon Production Research proprietary publication EPR.4EX.90, 350p.14 plates.

Butler, R.F., Gehrels, G.E., McClelland, W.C., May, S.R., and Klepacki, D.W., 1989, Discordant paleomagnetic poles from the Canadian Coast Plutonic Complex: Regional Tilt rather than large-scale displacement? *Geology*, v.17, no.8, p691-694.

Hauge T.H. and Klepacki, D.W., 1989, Extensional Fault-bend folds: Interpretational guidelines and seismic examples, Exxon Production Research proprietary report EPR. EX.88, 39p.

Klepacki, D.W., 1989, Structural hydrocarbon trap styles and their distribution *and* Structural development of the Western United States *in* Western Integrated Exploration Study final report. Exxon Production Research proprietary publication EPR.124ES.89,10p. 36 plates.

- Klepacki, D.W., 1989: Linkages between the western North American Miogeocline and adjacent marginal terranes in the central Kootenay Arc. in Geological Society of America Cordilleran and Rocky Mountain Sectional Meeting, Program with Abstracts, Spokane, WA
- Klepacki, D.W., 1988, Structural styles and distribution *and* Tectonic history of the New Guinea foldbelt *in* Joint Australian Indonesian New Guinea Study, final report. Exxon Company International proprietary report (EPR R01296) 165p. 109 plates.
- Wernicke, B. and Klepacki, D.W., 1988, Escape Hypothesis for the Stikine Block. *Geology*, v.16, no.5, p.461-464
- Klepacki, D., 1987, Constructing viable sections in extensional terrains: the critical role of shear orientation and accommodation. Penrose conference: The Construction of Geologic Cross Sections: Techniques, Assumptions and Methods., New Paltz, New York, 1987.
- Klepacki, D.W., 1987, Stratigraphy and structural geology of the Goat Range area, southeastern British Columbia (Ph.D. thesis): Cambridge, Massachusetts Institute of Technology, 252p.
- Tuminas, A.C., and Klepacki, D.W., 1987, Structural Analysis and restoration of the fault structures along the eastern flank of the Staffjord Field, Exxon Production Research proprietary report EPR.9ES.87 15 p. 24 plates.
- Walker, J.D., Klepacki, D.W., and Burchfiel, B.C., 1987, Reply on Late Precambrian tectonism in the Kingston Range California. *Geology*, v.15, no.3, p.275.
- Klepacki, D. W., 1986, Geology of the Goat Range, Lardeau (82K) and Nelson (82F) Map areas, Southeastern British Columbia, Geological Survey of Canada Open File Map 1148.
- Klepacki, D.W., and Phelps, D.W., 1986, Petrography and ⁴⁰Ar/³⁹Ar analysis of a mafic igneous intrusive in Exxon OCS Y-0599 #1, Redwood 1, Navarin Basin, Alaska, Exxon Production Research proprietary report EPR.146ES.86, 13p.
- Lingrey, S.H., and Klepacki, D.W., 1986, Advanced structural analysis: Compressional tectonics. Guidebook: Fold and thrust belts, the Canadian Rockies. 98p., 65 plates. Exxon Production Research proprietary report.
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